Appendix D.
Errors

All numbers in this book, except for sample size on table 2-1, are estimates. As in other surveys, errors come primarily from wrong answers, incomplete data, and sampling.

NONSAMPLING ERRORS

Nonsampling errors are usually the largest source of errors, larger than sampling errors. For example the changes in weighting in 1981 and 1991 (see appendix C) corrected some of the error due to incomplete data. Just that one correction averaged 2.5 percent in 1991. Worse errors from wrong answers and from incomplete data apply to some items, discussed in the next paragraphs.

Wrong or inconsistent answers. Wrong answers happen because people misunderstand questions, cannot recall the correct answer, or do not want to give the right answer. Table 1 shows which items have been measured for inconsistency when people are reinterviewed after a few weeks. The actual survey cannot catch and reconcile these inconsistencies, so a high rate of wrong answers remains for some items. The Census Bureau categorizes these levels of inconsistency into three ranges:

1. Less than 20 is considered a low level of inconsistency.
2. Between 20 and 50 is considered a moderate level of inconsistency.
3. Greater than 50 is considered a high level of inconsistency indicating that responses are not reliable.

Not all questions have been checked for inconsistencies. The ones checked were the questions where inconsistencies seemed likely. Questions measuring opinions were likely to have high inconsistencies.

The numbers in table 1 are percents. They are nearly the same as: 100 minus the correlation between answers in the original interview and the reinterview. For example, an inconsistency of 20 means a correlation of 80 percent, which is good. This is the correlation between answers to the same question, usually from the same respondents, a month apart. Wrong answers make results wrong and mean that data on groups (e.g., income groups) are infected with data from people who really are not like the group at all. Readers should be wary of drawing firm conclusions from items with high inconsistency.

Coverage errors. Each home in the AHS-N sample represents a large number of other homes. However, because of incomplete sampling lists (i.e., undercoverage) the homes in the survey do not represent all homes in the country. Therefore, the raw numbers from the survey are raised proportionally so that the numbers published here match independent estimates of the total number of homes. These independent estimates are based on the 1990 Census of Housing, plus an accounting of changes since then. Housing unit undercoverage is about 2.3 percent. Table A lists units that have known coverage deficiencies.

Table A. **Undercoverage Units**

Type of unit	Reason for undercoverage
Mobile homes	Poor coverage of new mobile home parks in address enumeration districts
Conventional new construction	Permits issued fewer than 6 months before interviewing are not considered
New construction in special places	Not covered in either permit or nonpermit areas
Whole structure additions	These units are chosen with the aid of screening questions. Eligible units could be missed and ineligible units included because of incorrect answers to the screening questions.
Conversions from nonresidential units	Nonresidential units at the time of the 1980 census which converted to residential units were missed.

Incomplete data. Incomplete data happen because sampling lists are incomplete; and because people refuse the interview or some of the questions, or do not know answers. Table 2 (at the end of this appendix) shows which items have the least complete data. These are primarily items that people forget or consider personal: mortgages, other housing costs, and income. The computer may assign or ''impute'' values for these items according to rules developed by subject matter specialists. We do not know how close the imputed values are to the actual values. Incompleteness can cause large errors, since when even 10 percent of homes are missed by a particular question, they represent about 10 million homes which have to be estimated, on little or no basis (there are about 100 million homes in the U.S.). The survey estimates them by assuming that they are like some group of homes which did give

data, an assumption which is never exactly true. Thus, it is not surprising that large biases, as shown in table 3, are possible when the survey has data for only 50 to 90 percent of homes for particular items. Again readers should be wary of items with highly incomplete data.[1]

Effect on income. The nonsampling errors interact particularly badly for income. Income questions are inconsistently answered (table 1), incompletely answered (table 2), and the totals fall short of totals known from the National Income Accounts, especially for the elderly.[2]

SAMPLING ERRORS

Definition. Error from sampling reflects how estimates from a sample vary from the actual value. (Note: ''actual value'' means the value that would appear if all housing units had been interviewed, under the same conditions, rather than only a sample. A confidence interval is a range which contains the actual estimate with a specified probability.)

Counts. Most numbers in this book are counts of housing units (e.g., units with basements or units with an elderly person). These counts have error from sampling. Table B gives a convenient list of errors for a range of numbers. These errors are an overestimate for most items. To get a more accurate answer, use the appropriate formula shown in tables 4a, 4b, or 4c (at the end of this appendix). As with the other types of errors, readers should be wary of numbers with large errors from sampling.

The error from sampling cannot be known exactly. We approximate it using the following formula for constructing a 90-percent confidence interval:

$$1.64 \times \sqrt{4.74 \times A - .000043 \times A^2}$$

where A is a number (a count of units) in this book.

This formula is an overestimate for most items. To get a more accurate estimate, use the appropriate formula in table 4a, 4b, or 4c.

For example if A is 200:

$$1.64 \times \sqrt{4.74 \times 200 - .000043 \times 200 \times 200} = 50$$

Table B. **Errors From Sampling to Compute a 90-Percent Confidence Interval**

When this book lists one of the following numbers—	The chances are 90 percent that the actual value is inside the range of plus or minus—
0	5
10	11
100	36
500	80
1,000	112
2,500	176
5,000	247
10,000	340
25,000	496
50,000	590
75,000	553
90,000	459
109,456	99

Source: These errors were computed based on a formula in table 4a, 4b, or 4c with high error. This table represents a conservative example. The numbers are in thousands.

The 90-percent confidence interval can then be formed by adding and subtracting this error to the survey estimate of 200 (i.e., 200 ± 50). Statements such as ''the actual value is in the range 200 ± 50 (150 to 250),'' are right 90 percent of the time and wrong 10 percent of the time.[3]

Numbers in the book are printed in thousands, so 200 means 200,000. The formulas are designed to use numbers directly from the book; do not add zeros. The result is also in thousands, so 50 means 50,000.

Percents. Any subgroup can be shown as a percent of a larger group. The error from sampling for a 90-percent confidence interval for this percent is:

$$1.64 \times \sqrt{4.74 \; P \; (100 - P) \; / A}$$

where P is the percent; A is the denominator, or base of the percent.[4]

This formula is an overestimate for most items. To get a more accurate estimate, replace the first number under the square root sign with the first number under the square root sign of the appropriate formula in table 4a, 4b, or 4c.

For example, the error from sampling for a 90-percent confidence interval for 40 percent of 200 (meaning 200,000) is:

$$1.64 \times \sqrt{4.74 \times 40 \times 60/200} = 12.4$$

Statements such as ''the actual percent is in the range 27.6 percent to 52.4 percent'' are right 90 percent of the time. This formula is an overestimate for most items. To get

[1] Statistical note: The November 1990 paper, *How Response Error, Missing Data and Undercoverage Bias Survey Data*, estimates that 90 percent of errors from incomplete data are less than: 200 + .58 x (lesser of A or 100,000 – A), where A is any count published in this book (in thousands, result also in thousands). Weights are adjusted to reduce these errors, but it is not known how much error remains. *How Response Error, Missing Data and Undercoverage Bias Survey Data,* order number HUD-6458, is available from HUD User at the address in the ''Explanations and Cautions'' section at the front of this book.

[2] Data are in the *Codebook for the American Housing Survey*, available from HUD User at the address in the ''Explanations and Cautions'' section at the front of this book.

[3] The formula in the text is based on 1.64 times the error from sampling. This formula gives ''90-percent confidence interval errors.'' For 95-percent confidence interval errors multiply by 1.96 instead of 1.64; for 99-percent confidence multiply by 2.58 instead of 1.64.

[4] This formula is actually $1.64 \times \sqrt{(p(100–p)/n)}$, since 4.74/A adjusts the data to the effective sample size.

a more accurate estimate, change the first number under the square root sign here, 4.74, to the first number given under the square root sign of the appropriate formula in table 4a, 4b, or 4c.

Note that when a ratio C/D is computed where C is *not* a subgroup of D (for example, the number of Hispanics as a ratio of the number of Blacks) the error from sampling is different. The error from sampling for a 90-percent confidence interval for a ratio C/D[5] is:

$$(C/D)\sqrt{((\text{error for C})/C)^2 + ((\text{error for D})/D)^2}$$

Medians. The following steps calculate the error from sampling for a 90-percent confidence interval for medians.[6]

Steps for calculations	The formula	An example	Your data
How many total units is the median based on (in thousands, exclude ''not reported'' and ''don't know'')?	A	200	___
What are the end-points of the category the median is in?	X - Y	$50-74	___
What is the width of this category (in dollars, rooms, or whatever the item measures)?	W	$25	___
How many housing units are in this median category (in thousands)?	B	30	___
Then the error from sampling for the median is approximately:[7]	$\frac{2.0 \times W \times \sqrt{A}}{B}$	$\frac{2.0 \times 25 \times \sqrt{200}}{30}$ = 24	___
The 90-percent confidence interval for the median is:	median $\pm \frac{2.0 \times W \times \sqrt{A}}{B}$	median ± $24	___

[5]The error for C should be interpreted as the error for a 90-percent confidence interval for C. Likewise, the error for D should be interpreted as the error for a 90-percent confidence interval for D.

[6]For small bases use the more accurate approach in table 5.

[7]The factor 2.0 is a conservative estimate for most items. For a better approximation, find the appropriate formula in table 4a, 4b, or 4c and divide the first number under the square root sign by 4.74. Take the square root of this answer and multiply by 2.0 to get your factor.

Differences. Two numbers from this book, like 34 and 40 or 40 percent and 45 percent have a ''statistically significant difference'' if their ranges of error from sampling for a 90-percent confidence interval do not overlap. When ranges of error for a 90-percent confidence interval do overlap, numbers are still statistically different if the result of subtracting one from the other is more than[8]:

$$\sqrt{(\text{error for 1st number})^2 + (\text{error for 2nd number})^2}$$

For example, if the first number is 34 with an error of 21 and the second number is 40 with an error of 23, then the 90-percent confidence interval error for this difference of 6 is:

$$\sqrt{21^2 + 23^2} = 31$$

Since the difference is less than this error, these two numbers are not statistically different.

[8]Error for first number should be interpreted as the error for a 90-percent confidence interval for the first number. Likewise, error for second number should be interpreted as the error for a 90-percent confidence interval for the second number.

Table 1. **Different Answers a Month Apart**

Item	When measured[1]	Level of inconsistency	Confidence interval[2]
Other kinds of heating equipment (central warm-air)	89-MS	91	[73-100]
Mortgage payment include anything else (first mortgage)	90-MS	90	[72-111]
Water came in from other places	89-MS	81	[64-100]
Moved for other, financial/employment	85-MS	80	(62-104)
Moved for other, housing related	85-MS	79	(65-97)
Police protection problem in neighborhood	89-MS	78	[63-95]
Poor city/county service in neighborhood	89-MS	78	[63-95]
Moved for other reason	85-MS	73	(64-85)
Moved for better quality house	85-MS	69	(58-82)
Moved because other family/personal related	85-MS	68	(54-86)
Cost for water supply and sewage disposal	81-N	68	(61-76)
Other problem in neighborhood	89-MS	67	[61-74]
Undesirable industries/businesses in neighborhood	89-MS	66	[54-82]
Rats	89-MS	65	[54-69]
Noise in neighborhood	89-MS	64	[57-72]
Other kinds of heating equipment (none)	89-MS	63	[60-67]
Peeling paint on the ceiling	81-N	63	(49-80)
Other kinds of heating equipment (unvented room)	89-MS	62	[45-86]
How LIKELY to move to place prefer to live in 5 years	85-MS	62	(54-71)
How LIKELY to still be living in this unit in 5 years	85-MS	60	(49-74)
Gross income	82-MS	59	not available
Open cracks or holes in building	81-N	58	(47-72)
Electric fuses or breaker switches blown	81-N	58	(50-68)
Other major repairs over $500 each—repair done	85-MS	57	(50-64)
People in neighborhood	89-MS	57	[52-62]
Central air conditioning/dehumidifier	80-N	56	not available
Satisfactory police protection	77-N	55	(49-62)
Moved for lower rent or less expensive house to maintain	85-MS	55	(43-70)
Broken plaster or peeling paint	89-MS	55	[46-65]
Water came in from walls, doors, windows	89-MS	55	[45-67]
A working electric wall outlet	77-N	55	(42-71)
Other kinds of heating equipment (fireplace with no insert)	89-MS	54	[49-59]
Shopping	77-N	54	(47-61)
Broken plaster on the ceiling	81-N	53	(40-70)
Water came in from roof	89-MS	53	[46-60]
Payments the same during whole length of the mortgage	85-MS	52	(46-59)
Litter in neighborhood	89-MS	51	[44-60]
Main reason moved	85-MS	51	(47-55)
Which best describes place at that time	85-MS	51	(46-55)
Yearly cost for garbage	81-N	51	(43-62)
Rate the place (10 categories)	89-MS	51	[49-53]
Other major repairs over $500 each—someone in household do work	85-MS	51	(36-72)
Other kinds of heating equipment (other built-in electric)	89-MS	50	[38-66]
Holes in the floors	81-N	50	(33-74)
Oil, coal, kerosene, wood and any other fuel cost	81-N	50	(40-64)
Type of vacant	81-N	50	(38-65)
Central air fuel	85-N	50	(40-63)
At age 16, live in this area/different place	85-MS	50	(44-57)
Public transportation	77-N	50	(44-56)
Cookstove or range with oven	85-N	50	(39-64)
Traffic in neighborhood	89-MS	49	[43-54]
Moved to establish own household	85-MS	48	(38-59)
Rate the place (categories 1-6 combined)	89-MS	48	[46-51]
Other kinds of heating equipment (portable electric)	89-MS	47	[41-54]
Real estate taxes	81-N	47	(33-67)

See footnotes at end of table.

Table 1. **Different Answers a Month Apart**—Con.

Item	When measured[1]	Level of inconsistency	Confidence interval[2]
Central air conditioning/none	80-N	47	not available
Crime in neighborhood	89-MS	47	[41-53]
Any additions built—repair done	85-MS	46	(35-61)
Water came in from basement	89-MS	45	[38-55]
Moved to change from owner to renter/renter to owner	85-MS	44	(36-55)
Number of living rooms	85-N	44	(33-57)
Major equipment, such as furnace or central air replace/added—repair done	85-MS	44	(35-55)
Five years from now, would you prefer living in this area or someplace else	80-N	44	(32-60)
Water leaked into home from outdoors	89-MS	43	[39-47]
Rate the place (four combined categories)	89-MS	43	[41-46]
Other kinds of heating equipment (fireplace with insert)	89-MS	43	[35-52]
Concealed wiring	89-MS	43	[33-57]
Siding replaced or added in last 2 years—repair done	85-MS	42	(32-56)
Heat breakdown	89-MS	41	[30-56]
Yearly cost of insurance (reported in $100 increments to $1,000)	89-MS	41	[38-44]
Moved to be closer to school/work	85-MS	41	(32-53)
Heating equipment broke down for 6 hours or more	89-MS	41	[30-56]
Cost for real estate taxes	81-N	40	(35-46)
Central air conditioning/portable fan	80-N	40	not available
Public elementary school satisfactory	89-MS	40	[34-47]
Mice or rats or signs of	76-N	40	not available
House/apartment cold for 24 hours	89-MS	40	[36-45]
Current mortgage same year as bought home	85-MS	39	(27-56)
Prefer to be living in another home in this area in 5 years	85-MS	38	(31-48)
Anything about the neighborhood that bothers you	89-MS	38	[35-41]
Change in taxes/insurance/principal balance	85-MS	37	(28-51)
Other kinds of heating equipment (stove)	89-MS	36	[28-47]
Bathrooms remodeled or added—repair done	85-MS	35	(28-45)
Married, widowed, divorced, or separated	85-MS	35	not available
Costs for gas for the month of August	89-N	35	[24-54]
All or part of roof replaced in last 2 years—repair done	85-MS	35	(29-42)
New storm doors or storm windows bought and installed—repair done	85-MS	33	(27 41)
Moved because needed larger house or apartment	85-MS	33	(26-41)
Number of other rooms	85-N	32	(28-38)
Kitchen remodeled or added—repair done	85-MS	32	(25-41)
Insulation added—repair done	85-MS	32	(25-44)
House and lot sell on today's market	90-MS	31	[29-34]
Moved for new job or job transfer	85-MS	30	(22-39)
Average monthly cost for gas	89-N	29	[23-37]
Average monthly cost for electricity	89-N	28	[24-34]
Number of dining rooms	85-N	27	(24-29)
Type of mortgage (for the first mortgage/loan) (non-CATI)	89-N	27	[21-36]
Change based on interest rates	85-MS	26	(18-38)
Year the building was built	85-MS	25	not available
All or part of roof replaced in last 2 years—someone in household do work	85-MS	25	(15-44)
Number of family rooms	85-N	25	(21-30)
Mortgage payment include homeowner's insurance (first mortgage)	90-MS	24	[21-27]
Prefer to be living in this house/apartment/someplace else	85-MS	24	(20-29)
Clothes washer age	85-N	22	(19-25)
Any other rooms	85-N	22	(20-25)
How many years for mortgage	85-MS	22	(17-29)
New storm doors/windows bought/installed—someone in household do work	85-MS	19	(11-35)
Attend a public school or a private school	89-MS	19	[15-25]
Oven/cooking burner age	85-N	18	(16-21)
Heating equipment broke	89-MS	18	[9-34]

See footnotes at end of table.

Table 1. **Different Answers a Month Apart**—Con.

Item	When measured[1]	Level of inconsistency	Confidence interval[2]
Clothes dryer age	85-N	18	(15-21)
Refrigerator age	85-N	18	(16-20)
Garbage disposal age	85-N	18	(15-22)
Insulation added—someone in household do work	85-MS	16	(8-33)
Monthly payment (first mortgage)	90-MS	16	[14-18]
Number of half bathrooms	85-N	16	(14-18)
New storm doors or storm windows bought and installed—job cost	85-MS	15	(8-32)
New assumed mortgage	85-MS	15	(11-22)
Mortgage payment include property tax (first mortgage)	90-MS	15	[12-18]
How much was borrowed	85-MS	14	(11-18)
Monthly payment (for first mortgage/loan) (non-CATI)	89-N	14	[11-19]
Dishwasher age	85-N	14	(11-17)
Where was mortgage borrowed (non-CATI)	89-N	13	[7-28]
Mortgage on this house/apartment	90-MS	13	[11-15]
How much was borrowed (for the first mortgage/loan)? (non-CATI)	89-N	13	[10-17]
Have property insurance	89-MS	12	[10-14]
Clothes dryer fuel	85-N	12	(9-14)
Number of room air conditioners	85-N	11	(9-15)
Interest rate on the mortgage (for the first mortgage/loan) (non-CATI)	89-N	10	[7-15]
Room air conditioners	85-N	10	(8-12)
Kitchen remodeled or added—someone in household do work	85-MS	9	(3-26)
Living quarters	85-N	8	(6-9)
Clothes washer	85-N	8	(6-9)
Number of units in building	85-N	8	(6-9)
Number of bedrooms	85-N	7	(6-8)
Number of full bathrooms	85-N	6	(5-8)
Dishwasher	85-N	6	(5-7)
Cooking fuel	85-N	5	(4-6)
Clothes dryer	85-N	5	(4-7)
Number of apartments	85-N	5	(4-8)
Garbage disposal	85-N	5	(4-7)
Central air conditioning	85-N	5	(4-6)

[1]This notation consists of the year followed by the survey from which the item was measured. For example, 89-MS means that the item was measured during the 1989 AHS-Metropolitan Survey (MS) and 81-N means that the item was measured during the 1981 AHS-National (N) Survey.

[2]The confidence intervals enclosed by square brackets are at the 90-percent significance level, all others are at the 95-percent significance level. The confidence intervals for the years prior to 1989 have a significance level of 95 percent, since that time it has been the policy of the U.S. Bureau of the Census to publish a 90-percent significance level for all testing.

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Table 2. **Completeness Rates for Characteristics**

[See completeness rates under nonsampling errors in appendix D for further details. ... means not applicable or sample too small. - means sero or rounds to zero.]

	Characteristics	Total occupied units	Tenure		Housing unit characteristics				Household characteristics				
							Physical problems						
			Owner	Renter	New construction 4 yrs	Mobile homes	Severe	Moderate	Black	Hispanic	Elderly (65+)	Moved in past year	Below poverty level
1	Total occupied housing units (000's)	97 693	63 544	34 150	5 329	6 164	2 022	4 348	11 773	7 757	20 841	17 204	14 695
2	Completeness of sampling lists (percent)[1]	98	98	96	80	86	98	98	90	96	100	94	97
3	All interviews[2] [3]	89	90	89	71	79	90	90	82	87	94	85	89
4	Total outstanding principal amount	44	44	...	43	20	41	33	29	48	33	48	28
5	Income sources of families and primary individuals	46	42	54	48	48	42	53	43	50	48	62	50
6	Current total loan as percent of value	48	48	...	58	45	47	50	47	59	39	69	44
7	Land rent fee	55	55	...	...	...	...	...	...	...	53	...	...
8	Mobile home park fee	59	59	...	...	59	...	...	...	...	71	...	...
9	Mobile home site placement	61	66	44	37	61	67	60	57	50	73	41	64
10	Ratio of value to current income	62	62	...	51	50	59	55	52	63	55	59	39
11	Lot size	64	70	38	53	53	61	56	41	47	72	42	51
12	Annual taxes paid per $5000 value	64	64	...	45	47	60	55	46	58	63	44	48
13	Current Interest rate	65	65	...	55	34	62	55	46	64	60	58	47
14	Monthly housing costs as percent of income	65	65	67	52	61	64	66	57	66	61	64	55
15	Monthly payment for principal and interest	70	70	...	60	53	67	68	61	75	63	68	55
16	Income of families and primary individuals	71	71	72	56	66	70	73	64	72	67	70	62
17	Light fixtures in public halls	71	74	71	59	...	73	72	66	70	76	70	71
18	Previous occupancy	71	74	63	68	58	70	67	58	64	74	65	62
19	Household income as percent of poverty level	71	71	72	56	66	70	73	64	72	68	70	63
20	Remaining years mortgaged	71	71	...	63	55	66	66	63	75	63	72	61
21	Units using each fuel	71	74	64	58	65	68	67	60	66	74	60	64
22	Household income	71	71	72	56	66	70	73	64	72	68	70	63
23	Average monthly cost for real estate taxes	72	72	...	50	59	73	70	57	68	78	49	63
24	Square feet per person	73	74	67	64	72	70	67	55	68	74	69	67
25	Square footage of unit	73	74	67	64	72	70	67	55	68	74	69	67
26	Value	74	74	...	62	57	70	65	62	73	70	69	60
27	Property insurance paid	74	70	81	54	69	77	79	68	76	76	75	74
28	Mobile homes in group	75	74	81	39	75	86	84	70	79	82	71	83
29	Monthly cost paid for water	75	73	78	56	70	77	71	66	72	79	70	73
30	Term of primary mortgage at origination or assumption	76	76	...	66	57	71	71	68	79	68	73	65
31	Household moves and formation in last year	76	77	75	59	67	76	72	66	71	85	71	74
32	Monthly cost paid for bottled gas	76	77	73	61	70	73	74	67	73	80	68	71
33	Monthly cost paid for piped gas	76	77	73	61	70	73	74	67	73	80	68	71
34	Purchase price	76	76	...	62	66	73	68	66	77	73	73	66
35	Items included in primary mortgage payment	77	77	...	64	59	77	74	67	79	76	70	65
36	Routine maintenance in last year	77	77	...	57	65	76	73	68	74	79	51	72
37	Amount of savings and investments	77	76	79	52	76	80	83	74	78	82	75	75
38	Monthly housing costs	78	77	79	61	71	77	79	70	78	79	75	73
39	Reasons for leaving previous unit	79	77	81	64	68	78	84	72	79	82	80	79
40	Owner or manager on property	79	...	79	62	...	81	80	71	77	85	76	77
41	Adult and single children < 18 years old	79	78	80	62	69	79	79	70	75	88	77	77
42	Severe physical problems	79	82	75	65	73	75	78	71	76	83	70	75
43	Monthly cost paid for trash	80	79	82	62	74	80	76	71	75	84	76	77
44	Condominium and cooperative fee	81	81	...	76	...	...	...	76	83	85	78	76
45	Tenure of previous residence	81	80	82	66	72	81	83	74	80	86	81	81
46	Mortgage origination	81	81	...	68	62	77	79	74	83	82	76	73
47	Type of primary mortgage	81	81	...	68	60	79	77	72	80	79	76	70
48	Structure type of previous residence	81	80	82	66	73	82	84	75	81	86	81	82
49	Home search	81	78	83	66	72	80	85	74	81	85	82	81
50	Selected amenities	81	83	78	63	70	81	79	73	79	87	74	80
51	Common stairways	82	84	82	68	...	82	83	75	82	86	81	82
52	Food stamps	82	82	81	54	78	83	85	76	80	89	78	79
53	Other buildings vandalized or with interior exposed	82	83	82	67	...	81	82	75	81	85	81	82
54	Recent mover comparison to previous home	82	79	83	67	72	81	86	75	81	85	83	82
55	Monthly cost paid for electricity	82	83	81	66	74	82	83	74	81	86	75	79
56	Neighborhood search	82	79	83	67	73	81	86	75	81	86	83	82
57	Lenders of primary and secondary mortgages	82	82	...	70	64	81	81	74	85	82	77	74
58	Choice of present home	82	79	83	67	73	80	86	75	81	85	82	82
59	Choice of present neighborhood	82	79	83	67	72	79	85	74	81	86	82	81
60	Homeowners association fee	82	82	...	73	...	86	...	69	76	87	75	80
61	Recent mover comparison to previous neighborhood	82	79	83	67	73	80	86	75	82	85	83	82
62	Description of area within 300 feet	83	84	83	68	...	84	84	76	83	86	82	83
63	Age of other residential buildings within 300 feet	83	84	83	68	...	84	84	76	82	86	82	82
64	Monthly cost paid for other fuels	83	83	83	66	73	82	83	77	83	88	80	81
65	Stories in structure	83	85	83	68	...	83	84	76	82	87	82	83
66	Conditions of streets	83	83	83	67	...	84	83	76	83	86	81	82
67	Persons other than spouse or children	83	83	83	66	73	80	82	78	82	78	81	80
68	External building conditions	83	85	83	68	...	83	84	76	83	87	82	83
69	Trash, litter or junk on streets or any properties	83	84	83	67	...	84	83	76	83	85	81	82
70	Stories between main and apartment entrances	83	85	83	69	...	83	83	76	84	87	82	83
71	Years of school completed by householder	84	84	83	68	75	83	84	76	82	87	83	82
72	Lower cost state and local mortgage	84	84	...	71	65	84	83	76	86	84	79	76

[1]Completeness of sampling lists: A small part of the total HU's in the U.S. is not represented in the AHS sample. This undercoverage occurs from imperfections in the sampling frame. We use weighting adjustments to account for these units. There are two main sources of undercoverage: (1) Deficiencies in sampling lists used for AHS (e.g.,1980 census or permit lists), and (2) Errors in the field resulting in completely overlooking certain HU's that belong in sample. The rate represents the proportion of HU's in the U.S. that are covered by the AHS sample frames.

[2]All interviews: A type A noninterview results when the interviewer is unable to obtain the necessary information to complete an interview from an occupied unit. We adjust the weights of interviewed units which most closely resemble type A noninterviews to help reduce the bias from these cases. The interview rate reflects the completeness of the sampling lists as well as the type A noninterviews.

[3]Compared to the 1991 publication, we switched rows 2 and 3. Type A noninterview rate (line 2 in 1991) is titled "All interviews" (line 3 in 1993). Undercoverage rate (line 3 in 1991) is titled "Completeness of sampling lists (percent)" (line 2 in 1993).

TIPSII [POSTSCRIPT] N95CTP DSP2 32090495 05/12/97 8:59 AM MACHINE: D DATA:DSP2*N95PDBSRTRAT. 05/12/97 08:58:53 OUTPUT:ON$ITE-P5191 PAGE: 1
TSF:DSP2*92. 05/12/97 08:58:55 UTF:DSP2*93. 05/12/97 08:58:55 META:DSP2*N95TIPCRTU96. 05/12/97 08:59:01

Total occupied units	In (P)MSAs		Outside (P)MSAs	Urban		Rural				Regions				
	Central cities	Suburbs		Total	Outside (P)MSAs	Total	Suburbs	Outside (P)MSAs	Farm	Northeast	Midwest	South	West	
97 693	30 243	45 864	21 586	70 683	7 914	27 010	13 173	13 673	1 509	19 200	23 662	34 236	20 596	1
98	97	98	98	98	98	97	96	97	99	100	98	96	96	2
89	88	89	91	89	92	90	89	91	92	93	90	89	87	3
44	45	45	38	46	42	39	42	36	25	41	47	41	46	4
														5
46	46	43	53	46	54	48	43	53	47	48	47	46	44	
48	50	46	50	48	54	47	45	48	38	43	48	52	44	6
55	...	49	43	68	...	36	...	40	...	...	...	63	...	7
59	...	58	51	77	...	40	37	43	...	...	52	56	66	8
61	56	61	62	58	55	62	61	63	62	74	56	62	57	9
62	62	63	61	64	65	60	62	59	50	63	64	60	64	10
64	53	66	71	59	60	74	73	76	83	73	64	64	59	11
64	61	65	63	65	67	62	63	61	54	69	67	58	65	12
65	64	66	59	66	63	61	63	58	54	65	68	59	69	13
65	64	66	66	65	68	66	66	65	57	65	66	65	66	14
70	70	70	70	71	74	68	69	68	53	69	72	70	69	15
71	70	71	73	71	74	72	72	72	67	70	72	71	72	16
71	72	70	73	71	73	74	73	75	...	79	73	68	64	17
71	68	72	69	70	67	72	74	70	65	79	70	70	68	18
71	70	71	73	71	74	72	72	72	68	71	72	71	72	19
71	71	71	70	72	72	69	70	68	61	72	73	69	70	20
71	67	72	74	69	73	73	73	74	73	71	73	70	69	21
71	70	71	73	71	74	72	72	72	68	71	72	71	72	22
72	68	73	75	72	76	73	72	74	73	79	75	68	71	23
73	69	75	72	72	68	75	76	74	76	73	69	73	78	24
73	69	75	72	72	68	75	76	74	76	73	69	73	78	25
74	74	75	72	76	76	71	72	70	62	76	76	71	75	26
74	74	72	77	74	78	75	73	77	72	78	74	73	72	27
75	77	77	74	79	76	74	74	74	67	86	74	75	73	28
75	71	77	76	73	68	79	78	80	85	85	76	69	73	29
														30
76	76	77	75	77	77	75	76	75	67	78	78	74	75	
76	75	77	78	77	80	75	75	76	76	79	78	74	76	31
76	73	76	80	74	78	80	79	80	80	77	75	79	71	32
76	73	76	80	74	78	80	79	80	80	77	75	79	71	33
76	76	76	75	77	78	73	74	73	68	78	78	73	76	34
77	76	76	80	76	82	78	77	79	75	76	79	76	76	35
77	76	76	78	77	79	76	76	77	81	78	78	75	77	36
77	77	76	81	77	81	79	76	81	79	78	78	78	75	37
78	77	78	79	78	80	78	77	79	74	79	79	78	77	38
79	80	79	80	80	82	77	75	78	72	85	80	77	80	39
79	79	79	83	79	83	81	79	84	...	83	81	75	79	40
79	78	78	81	79	82	79	77	81	80	82	80	77	76	41
79	76	80	82	78	80	82	81	83	84	80	80	79	77	42
80	77	81	81	78	75	84	82	85	90	89	81	75	78	43
81	83	81	79	82	...	80	81	...	...	84	78	84	80	44
81	81	81	82	82	84	79	77	80	61	86	82	79	81	45
81	81	81	82	82	84	81	81	81	79	84	83	79	80	46
81	79	81	82	81	85	80	80	81	75	83	83	78	79	47
81	81	81	83	82	84	79	78	81	65	86	82	80	80	48
81	81	81	83	82	85	79	77	81	69	87	82	79	81	49
81	80	81	82	81	82	81	81	82	83	84	85	78	79	50
82	82	83	81	83	81	80	82	78	...	87	82	79	79	51
82	80	80	85	81	86	83	81	85	85	83	83	81	79	52
														53
82	82	82	80	82	80	81	82	79	...	87	82	78	79	
82	82	82	83	83	85	80	78	82	72	88	82	80	81	54
82	80	82	85	82	84	84	83	85	85	84	83	83	80	55
82	82	81	84	83	86	80	77	82	66	87	83	80	81	56
82	81	82	83	83	86	82	82	82	80	85	84	81	81	57
82	82	81	83	82	84	79	77	81	69	87	82	79	81	58
82	82	81	83	82	84	79	77	81	69	87	82	80	81	59
82	78	82	89	81	84	83	81	90	...	88	82	80	83	60
														61
82	82	81	83	83	85	80	78	81	69	87	82	80	81	
83	84	84	81	83	82	81	82	80	...	89	84	79	81	62
83	83	83	81	83	81	81	81	81	...	89	83	79	80	63
83	83	84	84	84	86	82	81	83	81	88	85	82	80	64
83	83	84	81	83	82	82	83	81	...	88	84	80	81	65
83	83	83	80	83	80	79	80	79	...	88	83	78	80	66
83	81	83	85	82	85	84	83	85	87	86	83	83	80	67
83	83	83	82	83	82	81	82	80	...	89	84	79	81	68
83	83	83	80	83	81	79	80	78	...	88	83	79	80	69
83	83	84	82	83	83	81	83	78	...	88	83	80	80	70
84	83	84	86	84	86	84	83	85	86	86	86	82	83	71
84	84	85	85	85	87	84	84	84	84	88	86	82	83	72

Table 3. **Standard Errors of Bias Resulting From Incomplete Data**

Publication estimate	Standard error of bias
0	126
10	126
25	126
50	127
100	129
250	135
500	144
1,000	162
2,500	216
5,000	307
10,000	489
15,000	670
25,000	1,033
40,000	1,578
50,000	1,941
75,000	1,200
90,000	655
100,000	292
109,456	126

Error Formulas From Sampling to Compute a 90-Percent Confidence Interval

The letter ''A'' in the formulas in tables 4a through 4c represents a number (a count of units) in this book (see page D-2 for an example of how ''A'' is used).

Use the formulas in table 4b for items pertaining to fuels and heating/cooling equipment.

Use the formulas in table 4c for special items defined in that table.

Table 4a. **Error Formulas From Sampling to Compute a 90-Percent Confidence Interval for Items Not Listed in Tables 4b and 4c**

Characteristics	Error formulas
U.S., Elderly, Urban, Hispanic, Mobile homes, MSA-suburb, New construction, Central city, Black, Vacants	$1.64 \times \sqrt{2.48 \times A - 0.000023 \times A^2}$
Midwest	$1.64 \times \sqrt{2.48 \times A - 0.000095 \times A^2}$
West	$1.64 \times \sqrt{2.48 \times A - 0.000109 \times A^2}$
Northeast	$1.64 \times \sqrt{2.48 \times A - 0.000116 \times A^2}$
Rural, Outside MSA	$1.64 \times \sqrt{3.12 \times A - 0.000029 \times A^2}$
South	$1.64 \times \sqrt{3.12 \times A - 0.000080 \times A^2}$

Note: The formulas are based on 1.64 times the error from sampling. These formulas give 90-percent confidence interval errors. For 95-percent confidence interval errors multiply by 1.96 instead of 1.64; for 99-percent confidence interval errors, multiply by 2.58 instead of 1.64.

Table 4b. **Error Formulas From Sampling to Compute a 90-percent Confidence Interval for Items Pertaining to Fuels and Heating/Cooling Equipment**

Characteristics	Error formulas
U.S., Elderly, New construction, Outside MSA, Rural	$1.64 \times \sqrt{4.74 \times A - 0.000043 \times A^2}$
South	$1.64 \times \sqrt{4.74 \times A - 0.000121 \times A^2}$
Midwest	$1.64 \times \sqrt{4.74 \times A - 0.000182 \times A^2}$
West	$1.64 \times \sqrt{4.74 \times A - 0.000209 \times A^2}$
Northeast	$1.64 \times \sqrt{4.74 \times A - 0.000221 \times A^2}$
Central city, Mobile homes, Hispanic, Black, Urban, MSA-suburb	$1.64 \times \sqrt{2.48 \times A - 0.000023 \times A^2}$

Note: The formulas are based on 1.64 times the error from sampling. These formulas give 90-percent confidence interval errors. For 95-percent confidence interval errors, multiply by 1.96 instead of 1.64; for 99-percent confidence interval errors, multiply by 2.58 instead of 1.64.

Table 4c. **Error Formulas From Sampling to Compute a 90-Percent Confidence Interval for the Special Items Defined Below**

Characteristics	Error formulas
U.S., Northeast, Elderly, Midwest, South, New construction, Rural, West, Outside MSA	$1.64 \times \sqrt{5.53 \times A + 0.000605 \times A^2}$
Central city, Mobile homes, Hispanic, Black, Urban, MSA-suburb	$1.64 \times \sqrt{3.52 \times A + 0.000924 \times A^2}$

Note: The formulas are based on 1.64 times the error from sampling. These formulas give 90-percent confidence interval errors. For 95-percent confidence interval errors, multiply by 1.96 instead of 1.64; for 99-percent confidence interval errors, multiply by 2.58 insstead of 1.64.

The following are defined as special items:

1. Cooperatives or condominiums
2. No complete bathroom
3. Less than 1,500 square feet of detached one-family or mobile homes
4. Well serving 1 to 5 units
5. Mobile homes in a group
6. Area within 300 feet includes open space, park, farm, or ranch
7. Septic tank, cesspool, chemical toilet
8. Five or more acres in lot size
9. No bedroom
10. No complete bathroom
11. Lacking complete kitchen facilities
12. Lacking some plumbing facilities
13. No flush toilet
14. Major street repairs needed

Table 5. **Calculation of the 90-Percent Confidence Interval for Medians**

The following steps calculate the 90-percent confidence interval for medians. First we give some hypothetical cost data to work with (all numbers are in thousands):

		Cumulative number of housing units
Total housing units	209	-
Less than $25	50	50
$25 to $49	45	95
$50 to $74	30	125
$75 to $99	20	145
$100 or more	55	200
Not reported	9	-
Median	$54	-

Steps for calculations	Formula	Bottom limit		Top limit	
		Example	Your data	Example	Your data
How many total units is the median based on (in thousands, exclude 'not reported' and 'don't know')?	A	200			
Half the total, for the median (in thousands)	A/2	100			
Error from sampling for 50 percent of the base of this median (1st line)[1]	$178/\sqrt{A}$	12.6			
Multiply this percentage error by .01 to turn it into a fraction and by total units to give the error in housing units	$1.78\sqrt{A}$	25			
Bottom of error range (2nd line minus 4th line, in thousands)	B_{bottom}	75*			
Top of error range (2nd line plus 4th line, in thousands)	B_{top}			* 125	
* Start adding up the housing units in the table, category by category, cumulatively from the beginning of the table, until you exceed the starred number above. What interval does the starred number fall in?		$25-$49		$50-$74	
How many housing units are in all the categories before this one (in thousands)?	C	50		95	
How many housing units are in this category (in thousands)?	D	45		30	
What is the bottom limit of this category (in dollars, rooms, or whatever the item measures)?	E	$25		$50	
What is the bottom limit of the next category (in dollars, rooms, etc)?	F	$50		$75	
Formula to calculate the limits of confidence interval.	$\frac{B-C}{D}(F-E)+E$	$\frac{75-50}{45}(25)+25$		$\frac{125-95}{30}(25)+50$	
Limits of confidence interval (in dollars, rooms, etc)		$39		$75	

* Starting with the starred step, this worksheet is equivalent to interpolation, for those who are familiar with this term.

[1]Statistical note: This formula is based on the error from sampling for 50 percent (using the formula above, $1.64 \times \sqrt{(4.74 \times 50 \times (100-50)/A)} = 178/\sqrt{A}$). This formula is an overestimate for most items. For a more accurate answer, replace the first number under the square foot sign with the first number under the square root sign of the appropriate formula in table 4a, 4b, or 4c.